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SERIAL NUMBER	FILING DATE	CLASS	SUBCLASS	GROUP ART UNIT	EXAMINER
08/727,789	10/07/96	156	298	1733	Lorin

APPLICANTS

KEITH R. LEIGHTON, LORAIN, OH.

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FJL OK

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VERIFIED None
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ISSUE FEE IN FILE

TITLE

RADIO FREQUENCY IDENTIFICATION CARD AND HOT LAMINATION PROCESS FOR THE MANUFACTURE OF RADIO FREQUENCY IDENTIFICATION CARDS

U.S. DEPT. OF COMM./ PAT. & TM—PTO-436L (Rev.12-94)

PARTS OF APPLICATION FILED SEPARATELY

FJL 4-17-98
Applications Examiner

NOTICE OF ALLOWANCE MAILED	Assistant Examiner	CLAIMS ALLOWED: Total Claims	Print Claim
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CP 1680.00	7/6/98	Francis J. Lorin	6	12	7,8

Label Area

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ISSUE BATCH NUMBER C91

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Form PTO-436A (Rev. 8/92)

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08/727789

PATENT APPLICATION

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updated		13Apr98	FJL

INTERFERENCE SEARCHED

Class	Sub.	Date	Exmr.
156	298 312	13Apr98	FJL

SEARCH NOTES

	Date	Exmr.
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TYPIST		18	12-24
VERIFIER		MW	12/30
CORPS CORR.			
SPEC. HAND			
FILE MAINT.			
DRAFTING			

INDEX OF CLAIMS

Claim Final	Claim Original	Date
1	(1)	9/4/97 ✓
2	2	
3	3	
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SYMBOLS

- ✓ ..... Rejected
- = ... Allowed
- - (Through numberal) Canceled
- + ... Restricted
- N ..... Non-elected
- I ..... Interference
- A ..... Appeal
- O ..... Objected

Claim Final	Claim Original	Date
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Leighton

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INTERNATIONAL CLASSIFICATION
B 3 2 B 31/20

ORIGINAL CLASSIFICATION

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156	298

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CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)
156	312

GROUP ART UNIT
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PRIMARY EXAMINER (PLEASE STAMP OR PRINT FULL NAME)
Francis J. Lorin

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ISSUE CLASSIFICATION SLIP

U.S. DEPARTMENT OF COMMERCE
PATENT AND TRADEMARK OFFICE

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United States Patent [19]

Leighton

[11] **Patent Number: 5,817,207**

[45] **Date of Patent: Oct. 6, 1998**

[54] **RADIO FREQUENCY IDENTIFICATION CARD AND HOT LAMINATION PROCESS FOR THE MANUFACTURE OF RADIO FREQUENCY IDENTIFICATION CARDS**

[76] Inventor: **Keith R. Leighton**, 2817 Fulmer Rd., Lorain, Ohio 44053

[21] Appl. No.: **727,789**

[22] Filed: **Oct. 7, 1996**

Related U.S. Application Data

[60] Provisional application No. 60/005,685 Oct. 17, 1995.

[51] **Int. Cl.**[6] **B32B 31/20**

[52] **U.S. Cl.** **156/298**; 156/312

[58] **Field of Search** 156/300, 312, 156/311, 298

[56] **References Cited**

U.S. PATENT DOCUMENTS

4,450,024	5/1984	Haghiri-Tehrani et al.	156/108
4,701,236	10/1987	Vieilledent .	
4,792,843	12/1988	Haghiri-Tehrani et al. .	
4,795,898	1/1989	Bernstein et al. .	
4,980,802	12/1990	Champagne et al. .	
5,067,008	11/1991	Yanaka et al.	357/81
5,097,117	3/1992	Champagne et al. .	
5,173,840	12/1992	Kodai et al. .	
5,208,450	5/1993	Uenishi et al. .	
5,268,699	12/1993	Laute et al. .	
5,396,650	3/1995	Terauchi	455/38.2
5,412,192	5/1995	Hoss .	
5,438,750	8/1995	Venambre .	
5,567,362	10/1996	Grun .	

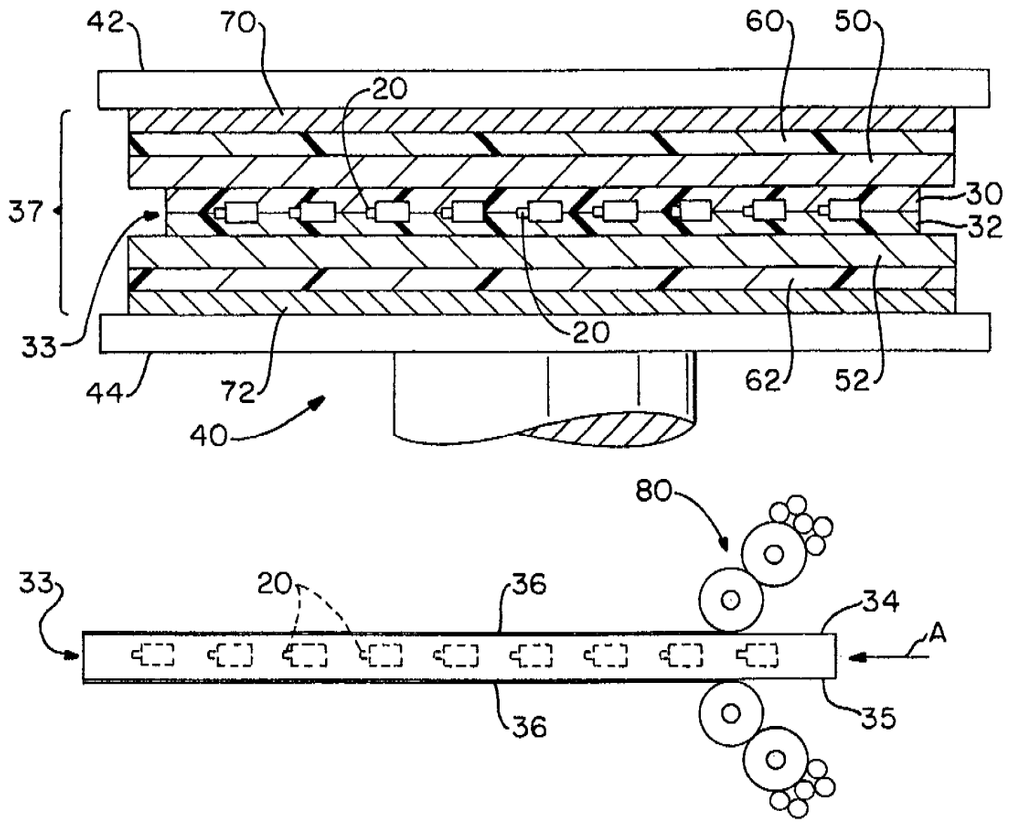
Primary Examiner—Francis J. Lorin

Attorney, Agent, or Firm—Oldham & Oldham Co., L.P.A.

[57] **ABSTRACT**

A plastic card, such as a radio frequency identification card, including at least one electronic element embedded therein and a hot lamination process for the manufacture of radio frequency identification cards and other plastic cards including a micro-chip embedded therein. The process results in a card having an overall thickness in the range of 0.028 inches to 0.032 inches with a surface suitable for receiving dye sublimation printing—the variation in card thickness across the surface is less than 0.0005 inches. A card manufactured in accordance with the present invention also complies with all industry standards and specifications. Also, the hot lamination process of the present invention results in an aesthetically pleasing card. The invention also relates to a plastic card formed in accordance with the hot lamination process of the present invention.

17 Claims, 3 Drawing Sheets



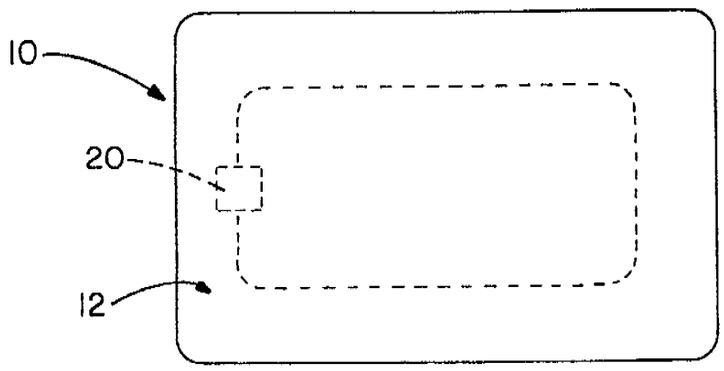


FIG.-1

FIG.-2

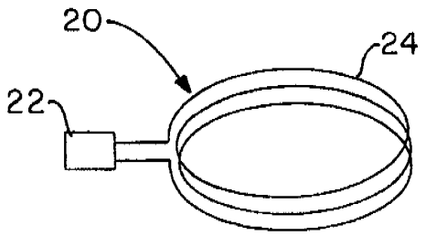


FIG.-3A

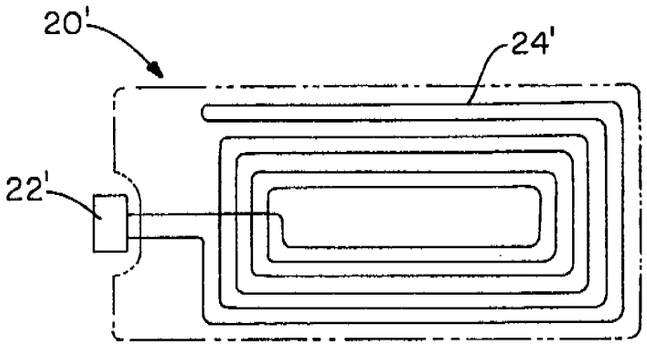


FIG.-3B

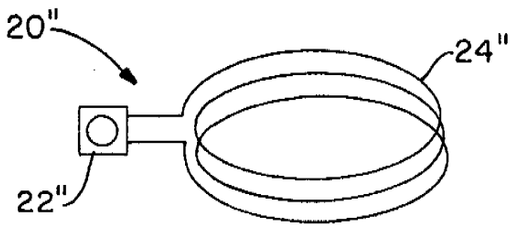


FIG.-3C

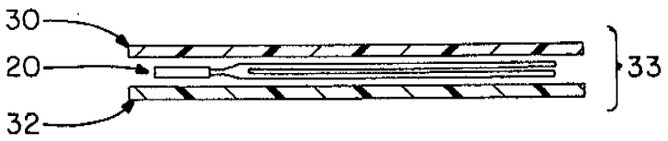


FIG.-4

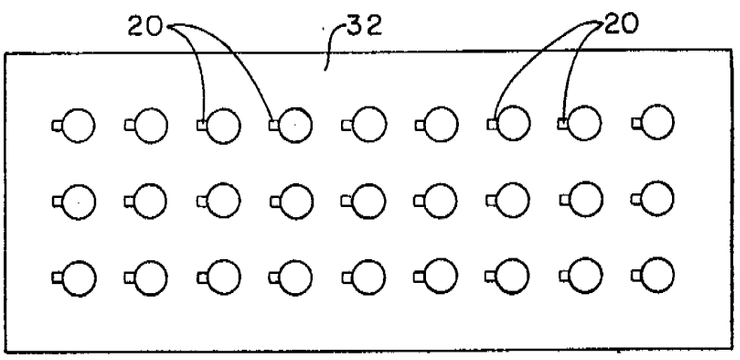


FIG.-5

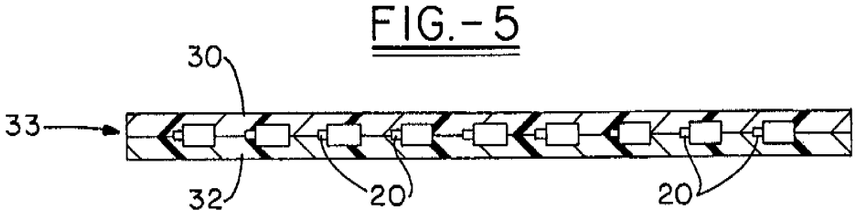


FIG.-6

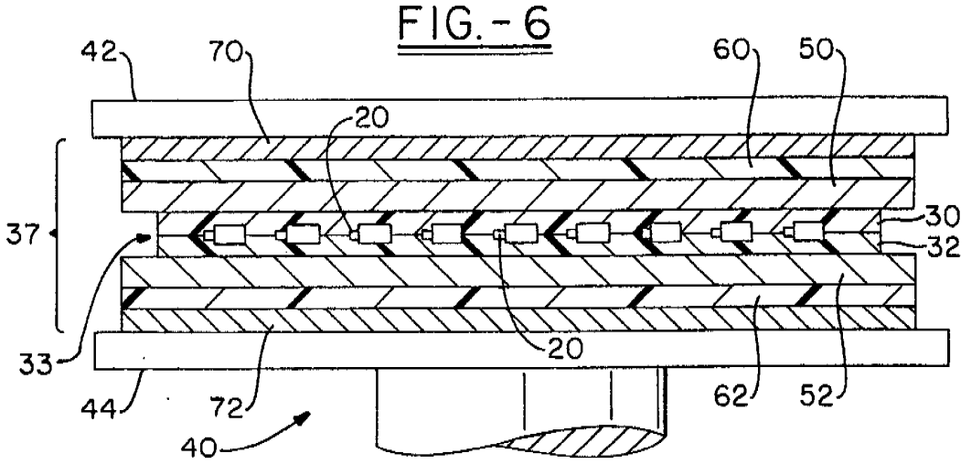


FIG.-7

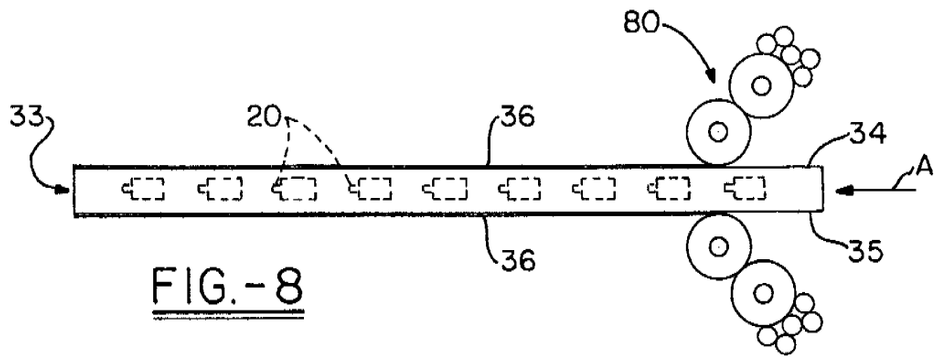


FIG.-8

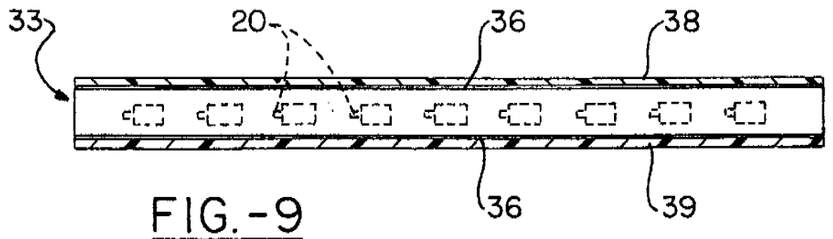


FIG.-9

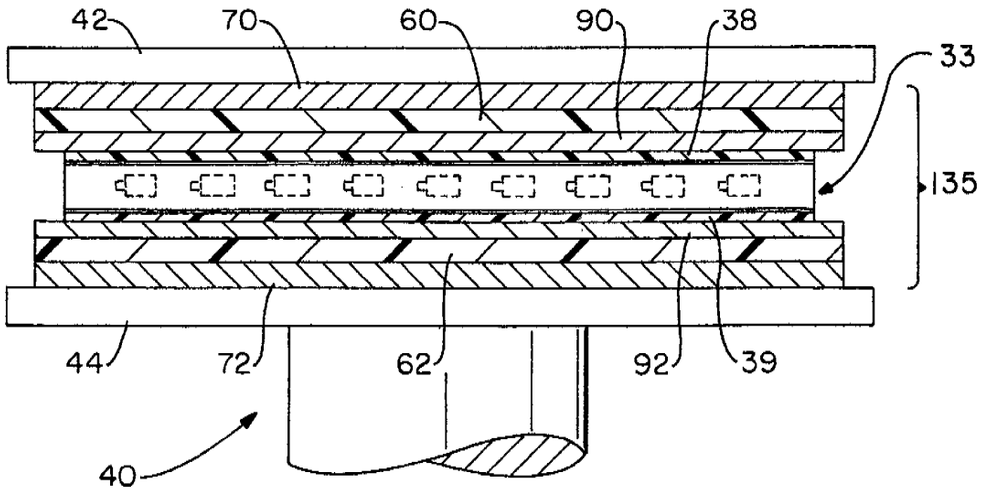


FIG.-10

RADIO FREQUENCY IDENTIFICATION CARD AND HOT LAMINATION PROCESS FOR THE MANUFACTURE OF RADIO FREQUENCY IDENTIFICATION CARDS

This application claims the benefit of the following: U.S. Provisional Application No.: 60/005,685, filing date Oct. 17, 1995.

FIELD OF THE INVENTION

The present invention relates generally to plastic cards and the manufacture thereof, and more particularly to radio frequency identification (RFID) cards and the manufacture of RFID cards that conform to industry size and performance standards and conventions and that have a superior outer surface to known RFID cards such that card may receive dye sublimation printing or the like.

BACKGROUND OF THE INVENTION

As the use of plastic cards for credit cards, automated teller machine (ATM) cards, identification cards, and like continues to become more widespread, the problems associated with the use of such cards correspondingly increase. Credit card fraud and identification card fraud are becoming larger problems everyday, and this fraud has introduced uncertainties into our systems of commerce and our security systems. Using easily available technology, criminals are able to manufacture credit/debit cards, ATM cards, identification cards, and the like having another's account code, identification code, or other personal information embedded in the magnetic stripe thereof. Thus, for example, criminals may steal hundreds or thousands of legitimate credit card account numbers and manufacture many additional cards bearing the stolen information. These fraudulent cards are then usable by the criminals to purchase goods and to receive cash with the legitimate card holder and the card issuer left holding the bill. Likewise, so called debit cards are becoming increasingly popular. These cards have stored thereon a certain amount of value for which the card owner has previously paid. For example, a subway rider may purchase a card good for 50 fares, with one fare being deducted from the card each time the owner rides the subway. Criminals have also been able to manipulate the data stored on these cards to defraud the merchants and others.

The ease in which criminals have been able to manufacture and or manipulate known cards results from the existence of the easily altered magnetic stripe storage medium used by known cards. These magnetic stripes are easily programmed and reprogrammed using commonly available technology. Thus, there has been found a need in the plastic card industry to provide a more secure plastic card that is very difficult or impossible to fraudulently manipulate. The most likely solution to the above-noted problems associated with known plastic cards is the RFID card and other cards including computer chips embedded therein rather than, or in addition to, a magnetic stripe. While these RFID cards and like have been found to be successful in preventing or limiting fraud, they are more difficult and expensive to manufacture relative to ordinary magnetic stripe cards. One of the biggest obstacles to the wide spread manufacture and use of RFID cards has been the inability of card manufacturers to manufacturer an RFID card that meets all industry standards and specifications, such as those set by the International Standards Organization (ISO), that are sufficiently aesthetically pleasing (wherein the embedded electronics are hidden from view), and that have a sufficiently regular or flat surface such that one or both surfaces of the card may be printed on using the very popular and widespread dye sublimation technology. Known plastic cards with computer chips and like embedded therein are too thick to work in connection with existing card reading machinery (ATM machines, telephones, and like) and have a surface that is too irregular to properly and consistently receive dye sublimation printing. Furthermore, prior attempts to manufacture a sufficiently thin plastic card including a computer chip embedded therein have resulted in a card with inferior aesthetic qualities such as the ability to see the embedded computer chip through the plastic.

SUMMARY OF THE INVENTION

The present invention is therefore directed to a plastic card having at least one electronic element embedded therein and to a hot lamination method for the manufacture of plastic cards including at least one electronic element therein. The card has an overall thickness in the range of 0.028 inches to 0.032 inches and comprises a plastic core having at least one electronic element embedded therein with at least one of the upper and lower surfaces of the core comprising a coating printed or otherwise applied thereon. An overlaminate film is preferably provided over the coated surface of the core and the resulting card has a variation in thickness across the surfaces thereof of no greater than approximately 0.0005 inches. The hot lamination method of the present invention comprises the steps of providing first and second plastic core sheets, positioning at least one electronic element between the first and second core sheets to thus form a core, and placing the core in a laminator and closing the laminator without applying laminator ram pressure to the core. A heat cycle is applied to the core sheets in the laminator thus liquefying or partially liquefying the sheets. The laminator ram pressure is then increased in combination with the heat. A cooling cycle is then applied to the core in the laminator, preferably with an associated increase in ram pressure, and the core is removed from the laminator. At least one surface of the core is then printed on using a printing press or similar printing apparatus, a sheet of overlaminate film is placed on at least one side of the core, and the core is then again placed in a laminator. A heat cycle is applied to the core with its overlaminate film, and a cooling cycle is thereafter applied, resulting in a sheet of plastic card stock from which one or more cards may be cut. The invention is also directed to a card manufactured in accordance with the above process which results in a plastic card having a thickness in the range of approximately 0.028 inches to 0.032 inches with a surface smoothness of at least approximately 0.0005 inches as is required by ISO and American National Standards Institute (ANSI) standards.

The present invention provides numerous advantages over known plastic cards and known plastic card manufacturing processes, including the formation of a plastic card with electronic elements such as a computer chip embedded therein with a pleasing aesthetic appearance, with a sufficiently smooth and regular surface such that the card may receive dye sublimation printing, and with sufficient durability and characteristics to comply with all industry specifications and standards.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a top plan view of a plastic card in accordance with the present invention;

FIG. **2** is a side elevational view of the card shown in FIG. **1**;

FIGS. 3A–3C are top plan views of various electronic elements that may be embedded in a card in accordance with the present invention;

FIG. 4 is an exploded, schematic view of an electronic element position between two plastic core sheets to form a core;

FIG. 5 is a top plan view of a plurality of electronic elements positioned on a sheet of plastic core stock such that they may be covered by a similar sheet of core stock;

FIG. 6 is a schematic cross-sectional view of one or more electronic elements positioned between sheets of plastic core stock;

FIG. 7 schematically illustrates a book comprising the core, as it is positioned in a laminator apparatus;

FIG. 8 schematically illustrates the core as it is being printed on after removal from the laminator using a printing press or similar printing apparatus;

FIG. 9 is a cross-sectional view schematically illustrating the application of an overlaminate film to at least one side of the core;

FIG. 10 schematically illustrates the core with overlaminate film, as it is placed in a laminator for final processing to form a sheet of card stock.

DETAILED DESCRIPTION OF THE INVENTION

The present invention relates to a plastic card including at least one electronic element embedded therein. The present invention also relates to a hot lamination process for the manufacture of plastic cards, and more particularly to a hot lamination process for the manufacturer of plastic cards that include an electronic element, such as a computer chip or other electronic element embedded therein. The electronic element may perform a wide variety of functions and take a wide variety of forms. Such cards, without regard to the particular electronic element embedded therein, will hereinafter be referred to as radio frequency identification (RFID) cards. The present invention also relates to a card formed in accordance with the invention.

Referring now to **FIG. 1**, there can be seen a plastic RFID card **10** manufactured in accordance with the present invention and including an electronic element **20** embedded therein. Card **10** includes an upper surface **12** and a lower surface **14**. Electronic element **20** may take a wide variety of forms and perform a wide variety of functions. As shown in FIG. 3A–3C respectively, electronic element **20**, **20'**, **20"** may be provided by a micro-chip **22** including a wire antenna **24** connected thereto, a micro-chip **22'** and a circuit board antenna **24'**, a read/write micro-chip **22"** and a wire coil antenna **24"**, or any other suitable electronic element. These electronic elements **20**, **20'**, **20"** and their insertion into plastic cards is not new, however, the present invention provides a new hot lamination process for manufacturing plastic cards **10** with these electronic elements **20**, **20'**, **20"** embedded therein such that the cards **10** are of a superior quality, such that the cards **10** meet all ISO and other industry specifications and standards, in such that at least one of the upper and lower surfaces **12**, **14** of card **10** is sufficiently smooth and is otherwise is capable of receiving dye sublimation printing. Specifically, a card in accordance with the present invention has a thickness of approximately in the range of 0.028 inches to 0.032 inches with a surface smoothness of 0.0005 inches.

As shown in FIGS. **4–10** one or more cards **10** in accordance with the present invention may be manufactured by positioning an electronic element **20** between first and second sheets of card stock **30**, **32** to form a core **33**. Preferably is shown in FIG. **5–10**, a plurality of cards are manufactured simultaneously, in thus, a plurality of electronic elements **20** are positioned between the first and second sheets of plastic core stock **30**, **32** (only the second sheet **32** begin shown in FIG. **5** for clarity). When a plurality of electronic elements **20** are positioned between first and second sheets plastic core stock **30**, **32**, electronic elements **20** are properly positioned relative to one another such that a plurality cards may be cut from the resulting card stock. Plastic core sheets **30**, **32** may be provided by a wide variety of plastics, the preferred being polyvinyl chloride (PVC) having a thickness in the range of 0.007 inches to 0.024 inches and preferably having a thickness of approximately 0.0125 inches each. Those skilled in the art will recognize that the thickness of the plastic core sheets will depend upon the thickness of the one or more electronic elements that are to be embedded therebetween. Other suitable plastics that may be utilized include polyester, acrylonitrile-butadiene-styrene (ABS), and any other suitable plastic.

Subsequent to placing one or more electronic elements **20** between the first and second sheets **30**, **32** of plastic core stock to form a core **33**, this core **33** is placed in a laminator apparatus **40** of the type well known in the art of plastic card manufacturing. As is shown in FIG. **7**, laminator **40** includes upper and lower platens **42**,**44** for applying ram pressure to an article positioned therebetween. In addition to the ability to apply ram pressure, laminator **40** is preferably of the type having controlled platens **42**,**44** that may provide both heat and chill cycles and preferably includes cycle timer to regulate cycle time. Core **33** is positioned between first and second laminating plates **50**, **52**, one of which is preferably matte finished to provide laminated core **33** with at least one textured outer surface. First and second laminating pads **60**, **62** are positioned outside of the laminating plates **50**, **52**, and first and second steel plates **70**, **72** are likewise positioned outside of pads of **60**, **62** and the entire assembly forms a book **35** for being positioned in laminator **40** between platens **42**, **44**.

Once book **35** is positioned in laminator **40** as shown in FIG. **7**, the first lamination cycle is initiated by closing laminator platens **42**, **44**, preferably applying little or no ram pressure to book **35**. A laminator heat cycle is initiated, bringing the temperature of platens **42**,**44** up to a range of 275° F. to 400° F., and most preferably up to a range of 300° F. to 370° F. for a period of greater than 5 minutes, and preferably in the range of 7 to 10 minutes. Once the heat cycle has been applied to the book **35** as is set forth above, the ram pressure of laminator **40** is increased to facilitate the flow of the plastic core sheets **30**, **32** so that the one or more electronic elements **20** are encapsulated there by, and so that sheets **30**, **32** form a uniform core **33** (seen most clearly in FIGS. **8–10**) with upper and lower surfaces **34**,**35**. As mentioned, the use of matte finished laminator plates **50**,**52** provides surfaces **34**,**35** with a slightly roughened or textured quality which will facilitate the application of a coating thereto as is discussed below. The ram pressure applied during the heat cycle and the length of the heat cycle may vary, depending especially upon the size of sheets **30**, **32**. For example, the cycle time may be in the range of 10–15 minutes. In one example, a ram pressure of 940.135 pounds per square inch (p.s.i.) was applied for 10–15 minutes to form a uniform core **33**, using sheets **30**,**32** of a size in the range of 12 inches by 24 inches to 24 inches by 36 inches.

Subsequent to the above heat cycle, laminator **40** applies a chill cycle to book **35** during which time the ram pressure

of the laminator **40** is increased, preferably by approximately 25% until the platens **42,44** have cooled to approximately 40° F. to 65° F. for approximately 10–15 minutes. Core **33** may then be removed from laminator **40** for additional processing.

Subsequent to the removal of core **33** from laminator **40**, and as illustrated in FIG. **8**, core **33** is coated on at least one of it's upper and lower surfaces **34, 35** with a layer of printing ink **36**. This may be accomplished using a wide variety of printing techniques such as offset printing, letterpress printing, screen printing, roller coating, spray printing, litho-printing, and other suitable printing techniques. As shown in FIG. **8**, core **33** is fed in the direction indicated with arrow A through a printing press, a lithographic printer, or a similar apparatus **80**. This printing step is performed to coat at least one surface **34, 35** of core **33** with a layer of aesthetically pleasing ink **36**. This layer of ink **36** cosmetically hides the one or more electronic elements **20** that are embedded within core **33**, and prevents these one or more electronic elements **20** from showing through the relatively thin core **33**. In this manner, the one or more electronic elements **20** encapsulated in core **33** are completely hidden from view without requiring the plastic used in the manufacture core **33** to be excessively thick.

Referring now to FIGS. **9–10**, the final processing of core **33**, which now comprises a layer of ink **36** or the like on at least one surface **34,35** thereof, is schematically illustrated. A layer of overlaminate film such as clear overlaminate film **38,39** is positioned on at least one ink coated surface **34,35** of core **33**, and preferably core **33** is positioned between two similar sheets of overlaminate film **38,39** as shown. Overlaminate film is very thin, for example in the range of 0.0015" thick. A book **135** is then constructed for insertion into laminator **40** as is schematically illustrated FIG. **10**. Book **135** comprising core **33**, including at least one layer of ink **36** and at least one layer of overlaminate film **38, 39** is positioned between laminating plates which are preferably highly polished plates such as mirror finished stainless steel plates **90, 92**. Book **135** also comprises first and second laminating pads **60, 62** and first and second steel plates **70, 72** as is discussed above in relation to FIG. **7**.

When book **135** is positioned between upper and lower platens **42,44** of laminator **40** as shown in FIG. **10**, the laminator is closed and a heat cycle in the range of 175° F. to 300° F., and most preferably in the range of 180° F. to 275° F., is applied to book **135** for a period of 10 to 25 minutes with a ram pressure that varies depending upon sheet size or the ram size of the laminator **40**, but which is typically approximately 1000 p.s.i. with an 18 inch diameter ram. The laminator **40** is then caused to execute a chill cycle, preferably with a corresponding increase in ram pressure. For example, the chill temperature may be in the range of 40° F. to 65° F. and last for a period of 10 to 25 minutes. A ram pressure increase of approximately 25% over the pressure used for the heat cycle has been found to be most preferable.

Subsequent to the above described second lamination cycle as illustrated in FIG. **10**, a sheet of plastic card stock is provided which comprises at least core **33** with at least one surface **34,35** thereof covered by a layer of ink **36**, and with at least one surface **34,35** thereof covered by a layer of overlaminate film **38, 39**. Preferably plastic card stock manufactured in accordance with the present invention comprises core **33** covered on both surfaces **34,35** with a layer of ink **36** which is positioned between layers of overlaminate film **38,39**, all of which has been laminated together as described. One or more cards **10** then may be cut from the resulting plastic card stock and card **10** will have a thickness in the range of 0.028 inches to 0.032 inches with variation in overall thickness across the surfaces **12, 14** thereof being no greater than approximately 0.0005 inches. The one or more cards **10** can thus be said to have a surface smoothness of approximately 0.0005 inches or better. Thus, a card **10** manufactured in accordance with the present invention includes at least one surface **12,14** at preferably both surfaces **12,14** that are sufficiently smooth and regular to receive dye sublimation printing.

Those skilled in the art will recognize that the foregoing description has set forth the preferred embodiment of the invention in particular detail and it must be understood that numerous modifications, substitutions, and changes may be undertaken without departing from the true spirit and scope of the present invention as defined by the ensuing claims.

What is claimed is:

1. A process for incorporating at least one electronic element in the manufacture of a plastic card, comprising the steps of:

(a) providing first and second plastic core sheets;

(b) positioning said at least one electronic element in the absence of a non-electronic carrier directly between said first and second plastic core sheets to form a core, said plastic core sheets defining a pair of inner and outer surfaces of said core;

(c) positioning said core in a laminator apparatus, and subjecting said core to a heat and pressure cycle, said heat and pressure cycle comprising the steps of:

(i) heating said core for a first period of time;

(ii) applying a first pressure to said core for a second period of time such that said at least one electronic element is encapsulated by said core;

(iii) cooling said core while applying a second pressure to said core,

(d) coating at least one of said outer surfaces of said core with a layer of ink; and

(e) applying a layer of overlaminate film to at least one of said outer surfaces of said core.

2. The process for incorporating at least one electronic element in the manufacture of a plastic card as recited in claim **1**, wherein said laminator apparatus has first and second laminating plates, at least one of said first and second laminating plates having a matte finish for creating a textured surface on at least one of said outer surfaces of said core.

3. The process for incorporating at least one electronic element in the manufacture of a plastic card as recited in claim **2**, wherein each of said first and second laminating plates has a matte finish for creating said textured surface on both of said outer surfaces of said core.

4. The process for incorporating at least one electronic element in the manufacture of a plastic card as recited in claim **1**, wherein said first and second plastic core sheets are made from a material selected from the group consisting of polyvinyl chloride, polyester, and acrylonitrile-butadiene-styrene, each of said sheets having a thickness in the range of 0.007 to 0.024 inch.

5. The process for incorporating at least one electronic element in the manufacture of a plastic card as recited in claim **4**, wherein said first and second plastic core sheets have a thickness of approximately 0.0125 inch.

6. The process for incorporating at least one electronic element in the manufacture of a plastic card as recited in claim **1**, wherein said second pressure is greater than said first pressure.

7. The process for incorporating at least one electronic element in the manufacture of a plastic card as recited in claim 6, wherein said second pressure is at least approximately 25% greater than said first pressure.

8. The process for incorporating at least one electronic element in the manufacture of a plastic card as recited in claim 1, wherein said core is heated in step (c)(i) to a temperature in the range of 275° F. to 400° F. and said first period of time is at least five (5) minutes.

9. The process for incorporating at least one electronic element in the manufacture of a plastic card as recited in claim 1, wherein said first pressure is approximately 1000 p.s.i. and said second period of time is at least 10 minutes.

10. The process for incorporating at least one electronic element in the manufacture of a plastic card as recited in claim 1, wherein said step (d) is carried out utilizing a printing press.

11. The process for incorporating at least one electronic element in the manufacture of a plastic card as recited in claim 1, wherein said step (d) is carried out utilizing a coating technique selected form the group consisting of silk screen printing, offset printing, letterpress printing, screen printing, roller coating, spray printing, and litho-printing.

12. The process for incorporating at least one electronic element in the manufacture of a plastic card as recited in claim 1, wherein said step (e) of applying a layer of overlaminate film comprises the further steps of:

(a) positioning an overlaminate film on at least one ink coated surface of said core;

(b) subjecting said core to a second heat and pressure cycle comprising the steps of:

(i) heating said core to a temperature between approximately 175° F. to 300° F. for approximately 10 to 25 minutes;

(ii) applying approximately 1000 p.s.i. pressure to said core; and

(iii) cooling said core to a temperature in the range of approximately 40° F. to 65° F. for approximately 10 to 25 minutes.

13. The process for incorporating at least one electronic element in the manufacture of a plastic card as recited in claim 1, wherein said at least one electronic element is a micro-chip and an associated wire antenna.

14. The process for incorporating at least one electronic element in the manufacture of a plastic card as recited in claim 1, wherein said at least one electronic element is a micro-chip and an associated circuit board antenna.

15. The process for incorporating at least one electronic element in the manufacture of a plastic card as recited in claim 1, wherein said at least one electronic element is a read/write integrated chip and an associated antenna.

16. A hot lamination process for the manufacture of plastic cards, said process comprising the steps of:

(a) providing first and second plastic core sheets;

(b) positioning at least one electronic element in the absence of a non-electronic carrier directly between said first and second plastic core sheets to form a layered core;

(c) positioning said core in a laminator apparatus, and subjecting said core to a heat and pressure cycle, said heat and pressure cycle comprising the steps of:

(i) heating said core in said laminator, in the presence of a minimal first ram pressure, to a temperature which causes controlled flow of said plastic which makes up said first and second plastic core sheets;

(ii) applying a second pressure uniformly across said core for encapsulating said at least one electronic element within said controlled flow plastic;

(iii) subsequently cooling said core in conjunction with the concurrent application of a third pressure uniformly across said core, said core including and upper and lower surfaces;

(d) printing on at least one of said upper and lower surfaces of said core such that a layer of ink is applied to at least a portion of said at least one upper and lower surface of said core.

17. The method as recited in claim 16 wherein said first and second core layers are devoid of any appreciable cut-outs.

* * * * *

PATENT APPLICATION SERIAL NO. 08/727789

U.S. DEPARTMENT OF COMMERCE
PATENT AND TRADEMARK OFFICE
FEE RECORD SHEET

310 CS 10/23/96 08727789
1 201 407.00 CK 6014-1

PTO-1556
(5/87)

BAR CODE LABEL

U.S. PATENT APPLICATION

SERIAL NUMBER	FILING DATE	CLASS	GROUP ART UNIT
08/727,789	10/07/96	428	1315

APPLICANT

KEITH R. LEIGHTON, LORAIN, OH.

CONTINUING DATA********
VERIFIED PROVISIONAL APPLICATION NO. 60/005,685 10/17/95

_____

FOREIGN/PCT APPLICATIONS********
VERIFIED

_____

FOREIGN FILING LICENSE GRANTED 12/24/96 ***** SMALL ENTITY *****

STATE OR COUNTRY	SHEETS DRAWING	TOTAL CLAIMS	INDEPENDENT CLAIMS	FILING FEE RECEIVED	ATTORNEY DOCKET NO.
OH	6	22	2	$407.00	6014-1

ADDRESS

STEVEN M HAAS
OLDHAM & OLDHAM CO
1225 WEST MARKET STREET
AKRON OH 44313-7188

TITLE

RADIO FREQUENCY IDENTIFICATION CARD AND HOT LAMINATION PROCESS FOR THE MANUFACTURE OF RADIO FREQUENCY IDENTIFICATION CARDS

This is to certify that annexed hereto is a true copy from the records of the United States Patent and Trademark Office of the application which is identified above.

By authority of the
COMMISSIONER OF PATENTS AND TRADEMARKS

Date Certifying Officer

08/727789

Form 4-1

PATENT

Attorney's Docket No. 6014-1

Box Patent Application
Commissioner of Patents and Trademarks
Washington, D.C. 20231

NEW APPLICATION TRANSMITTAL

Transmitted herewith for filing is the patent application of inventor(s):

Leighton, Keith R.

For (title):

Radio Frequency Indentification Card and Hot Lamination Process for the Manufacture of Radio Frequency Indentification Cards

1. Type of Application

This new application is a(n) (check one applicable item below):

- ■ Original
- ☐ Design
- ☐ Plant
- ☐ Divisional
- ☐ Continuation
- ☐ Continuation-in-part (CIP)

CERTIFICATION UNDER 37 CFR 1.10

I hereby certify that this New Application Transmittal and the documents referred to as enclosed therein are being deposited with the United States Postal Service on this Date October 7, 1996 in an envelope as "Express Mail Post Office to Addressee" Mailing Label Number EM343704835US addressed to the: **Commissioner of Patents and Trademarks, Washington, D.C. 20231**.

Jody L. Englehart
(Type or Print Name of Person Mailing Paper)

(Signature of Person Mailing Paper)

AA

Form 4-1

2. Benefit of Prior Application(s) (35 USC 120)

■ The new application being transmitted claims the benefit of prior U.S. application(s) and enclosed are **ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF PRIOR U.S. APPLICATION(S) CLAIMED.**

3. Papers Enclosed Which Are Required For Filing Date Under 37 CFR 1.53(b) (Regular) or 37 CFR 1.153 (Design) Application

15 Pages of Specification

7 Pages of Claims

1 Pages of Abstract

6 Sheets of Drawing

☐ formal
■ informal

4. Additional Papers Enclosed

☐ Preliminary Amendment
☐ Information Disclosure Statement (37 CFR 1.98)
☐ Form PTO-1449
☐ Citations
☐ Declaration of Biological Deposit
☐ Submission of "Sequence Listing," computer readable copy and/or amendment pertaining thereto for biotechnology invention containing nucleotide and/or amino acid sequence.
☐ Authorization of Attorney(s) to Accept and Follow Instructions from Representative
☐ Special Comments
☐ Other

5. Declaration or Oath

■ Enclosed

Executed by: (check **all** applicable boxes)

■ inventor(s).

☐ legal representative of inventor(s). 37 CFR 1.42 or 1.43

☐ joint inventor or person showing a proprietary interest on behalf of inventor who refused to sign or cannot be reached.

- ☐ this is the petition required by 37 CFR 1.47 and the statement required by 37 CFR 1.47 is also attached. See item 13 below for fee.

☐ Not enclosed.

- ☐ Application is made by a person authorized under 37 CFR 1.41(c) on behalf of **all** the above named inventor(s). (The declaration or oath, along with the surcharge required by 37 CFR 1.16(e) can be filed subsequently).
  - ☐ Showing that the filing is authorized. (Not required unless called into question. 37 CFR 1.41(d).)

6. Inventorship Statement

The inventorship for all the claims in this application are:

■ The same

OR

☐ Are not the same. An explanation, including the ownership of the various claims at the time the **last** claimed invention was made,

- ☐ is submitted.
- ☐ will be submitted.

7. Language

■ English

☐ non-English

- ☐ the attached translation is a verified translation. 37 CFR 1.52(d).

8. Assignment

☐ An assignment of the invention to_____

☐ is attached. A separate ☐"COVER SHEET FOR ASSIGNMENT (DOCUMENT) ACCOMPANYING NEW PATENT APPLICATION" or ☐ FORM PTO 1906 is also attached.

☐ will follow.

9. Certified Copy

Certified copy(ies) of application(s)

(country)	(application no.)	(filed)
(country)	(application no.)	(filed)

from which priority is claimed

☐ is(are) attached.

☐ will follow.

10. Fee Calculation (37 CFR 1.16)

A. ■ Regular Application

CLAIMS AS FILED				
Number Filed	**Number Extra**		**Rate**	**Basic Fee 37 CFR 1.16(a) $770.00**
Total Claims(37 CFR 1.16(c))	**22-20 =**	**2X**	**$ 22.00**	**44.00**
Independent Claims (37 CFR 1.16(b))	**- 3 =**	**X**	**$ 80.00**	
Multiple Dependent Claims(s), if any (37 CFR 1.16(d))			**$260.00**	

☐ Amendment canceling extra claims enclosed.

☐ Amendment deleting multi-dependencies enclosed.

☐ Fee for extra claims is not being paid at this time.

Filing Fee Calculation **$ 814.00**

B. ☐ **Design Application**
($300.00--37CFR 1.16(f))
Filing Fee Calculation $_____

C. ☐ **Plant Application**
($490.00--37CFR 1.16(g)
Filing Fee Calculation $_____

11. Small Entity Statement(s)

■ Verified Statement(s) that this is a filing by a small entity under 37 CFR 1.9 and 1.27 is(are) attached.

Filing Fee Calculation (50% of **A, B** or **C** above) $_____

12. Request for International-Type Search (37 CFR 1.10.(d)) (complete, if applicable)

☐ Please prepare an international-type search report for this application at the time when national examination on the merits takes place.

13. Fee Payment Being Made At This Time

☐ Not enclosed

☐ No filing fee is to be paid at this time. (This and the surcharge required by 37 CFR 1.16(e) can be paid subsequently.)

■ Enclosed

■ basic filing fee $ 407.00

☐ recording assignment ($40.00; 37 CFR 1.21(h)) $_____

☐ petition fee for filing by other than all the inventors or person on behalf of the inventor where inventor refused to sign or cannot be reached. ($130.00; 37 CFR 1.47 and 1.17(h)) $_____

☐ for processing an application with a specification in a non-English language. ($130.00; 37 CFR 1.52(d) and 1.17(k) $_____

☐ processing and retention fee ($130.00; 37 CFR 1.53(d) and 1.21(l)) $_____

☐ fee for international-type search report ($40.00; 37 CFR 1.21(e)). $_____

Total Fees Enclosed $ 407.00

FORM 4-1

14. Method of Payment of Fees

■ Check in the amount of **$** 407.00

☐ Charge Account No. ____ in the amount of **$**_____. **A duplicate of this transmittal is attached.**

15. Authorization to Charge Additional Fees

☐ The Commissioner is hereby authorized to charge the following additional fees by this paper and during the entire pendency of this application to Account **15-0450** .

☐ 37 CFR 1.16(a), (f), or (g) (filing fees)

☐ 37 CFR 1.16(b), (c), or (d) (presentation of extra claims)

☐ 37 CFR 1.16(e) (surcharge for filing the basic filing fee and/or declaration on a date later than the filing date of the application)

☐ 37 CFR 1.17 (application processing fees)

☐ 37 CFR 1.18 (issue fee at or before mailing of Notice of Allowance, pursuant to 37 CFR 1.311(b))

16. Instructions As To Overpayment

☐ Credit Account No._____

■ Refund

Reg. No.37,841

Steven M. Haas

SIGNATURE OF ATTORNEY

Telephone No.: (330)864-5550

Steven M. Haas

TYPE OR PRINT NAME OF ATTORNEY

OLDHAM & OLDHAM CO., L.P.A.
1225 West Market Street
Akron, Ohio 44313-7188

FORM 4-1

■ **Incorporation by reference of added pages**

Check the following item if the application in this transmittal claims the benefit of prior U.S. application(s) (including an international application entering the U.S. stage as a continuation, divisional or C-I-P application) and complete and attach the ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF PRIOR U.S. APPLICATION(S) CLAIMED

■ Plus Added Pages For New Application Transmittal Where Benefit of Prior U.S. Application(s) Claimed

Number of pages added 5

□ Plus Added Pages For Papers Referred To In Item 4 Above

Number of pages added_____

□ Plus "Assignment Cover Letter Accompanying New Application"

Number of pages added_____

□ **Statement Where No Further Pages Added**

(If no further pages form a part of this Transmittal then end this Transmittal with this page and check the following item)

□ This transmittal ends with this page.

(Ref.6-1-7/95 Pub.605) **FORM 4-1.1** 4-17

Attorney's Docket No. 6014-1 **PATENT**

ADDED PAGES FOR APPLICATION TRANSMITTAL WHERE BENEFIT OF PRIOR U.S. APPLICATION(S) CLAIMED

NOTE: "In order for an application to claim the benefit of a prior filed copending national application, the prior application must name as an inventor at least one inventor named in the later filed application and disclose the named inventor's invention claimed in at least one claim of the later filed application in the manner provided by the first paragraph of 35 U.S.C. 112." 37 CFR 1.78(a).

NOTE: "In addition the prior application must be (1) complete as set forth in § 1.51 or (2) entitled to a filing date as set forth in § 1.16; or (3) entitled to a filing date as set forth in § 1.53(b) and have paid therein the processing and retention fee set forth in § 1.21(l) within the time period set forth in § 1.53(d)." 37 CFR 1.78(a).

17. Relate Back

WARNING: If an application claims the benefit of the filing date of an earlier filed application under 35 U.S.C. 120, 121 or 365(c), the 20-year term of that application will be based upon the filing date of the earliest U.S. application that the application makes reference to under 35 U.S.C. 120, 121 or 365(c). (35 U.S.C. 154(a)(2) does not take into account, for the determination of the patent term, any application on which priority is claimed under 35 U.S.C. 119, 365(a) or 365(b).) For a c-i-p application, applicant should review whether any claim in the patent that will issue is supported by an earlier application and, if not, the applicant should consider canceling the reference to the earlier filed application. The term of a patent is not based on a claim-by-claim approach. See Notice of April 14, 1995, 60 Fed. Reg. 20,195, at 20,205.

(complete the following , if applicable)

■ Amend the specification by inserting, before the first line, the following sentence: "This application claims the benefit of the following:

A. 35 U.S.C. 119(e)

NOTE: "Any nonprovisional application claiming the benefit of one or more prior filed copending provisional applications must contain or be amended to contain in the first sentence of the specification following the title a reference to each such prior provisional application, identifying it as a provisional application, and including the provisional application number (consisting of series code and serial number)." 37 C.F.R. § 1.78(a)(4).

■ "U.S. Provisional Application(s) No(s).:

APPLICATION NO(S):	FILING DATE
60 / 005,685	10/17/95
___ / _____	_____
___ / _____	_____

B. 35 U.S.C. 120, 121 and 365(c)

NOTE: "Any nonprovisional application claiming the benefit of one or more prior filed copending nonprovisional applications or international applications designating the United States of America must contain or be amended to contain in the first sentence of the specification following the title a reference to each such prior application, identifying it by application number (consisting of the series code and serial number er) or international application number and international filing date and indicating the relationship of the application. Cross-references to other related application may be made when appropriate. (See § 1.12(b))." 37 C.F.R. § 1.78(2).

☐ "This application is a

- ☐ continuation
- ☐ continuation-in-part
- ☐ divisional

of copending application(s)

☐ application number 0 /_____ filed on _____"

☐ International Application _____ filed on _____ and which designated the U.S."

NOTE: The proper reference to a prior filed PCT application that entered the U.S. national phase is the U.S. serial number and the filing date of the PCT application that designated the U.S.

NOTE: (1) Where the application being transmitted adds subject matter to the International Application, then the filing can be as a continuation-in-part or (2) if it is desired to do so for other reasons then the filing can be as a continuation.

☐ "The nonprovisional application designated above, namely application ____ / _____, filed _____, claims the benefit of U.S. Provisional Application(s) No(s).:

APPLICATION NO(S).:

_____ / _____ _____"

_____ / _____ _____"

_____ / _____ _____"

NOTE: The deadline for entering the national phase in the U.S. for an international application was clarified in the Notice of April 18, 1987 (1079 O.G. 32 to 46) as follows:

"The Patent and Trademark Office considers the International application to be pending until the 22nd month from the priority date if the United States has been designated and no Demand for International Preliminary Examination has been filed prior to the expiration of the 19th month from the priority date and until the 32nd month from the priority date if a Demand for International Preliminary Examination which elected the United States of America has been filed prior to the expiration of the 19th month from the priority date, provided that a copy of the international application has been communicated to the Patent and Trademark Office within the 20 or 30 month period respectively, the international application becomes abandoned as to the United States 20 or 30 months from the priority date respectively. These periods have been placed in the rules as paragraph (h) of § 1.494 and paragraph (i) of § 1.495. A continuing application under 35 U.S.C. 365(c) and 120 may be filed anytime during the pendency of the international application."

18. Relate Back--35 U.S.C. 119 Priority Claim for Prior Application

The prior U.S. application(s), including any prior International Application designating the U.S., identified above in item 17B, in turn itself claim(s) foreign priority(ies) as follows:

country	appln. no.	filed on

The certified copy(ies) has (have)

☐ been filed on _____, in prior application 0 / _____, which was filed on _____.

☐ is (are) attached.

WARNING: *The certified copy of the priority application that may have been communicated to the PTO by the International Bureau may **not** be relied on without any need to file a certified copy of the priority application **in the continuing application**. This is so because the certified copy of the priority application communicated by the International Bureau is placed in a folder and is not assigned a U.S. serial number unless the national stage is entered. Such folders re disposed of if the national stage is not entered. Therefore, such certified copies may not be available if needed later in the prosecution of a continuing application. An alternative would be to physically remove the priority documents from the folders and transfer them to the continuing application. The resources required to request transfer, retrieve the folders, make suitable record notations, transfer the certified copies, enter and make a record of such copies in the Continuing Application re substantial. Accordingly, the priority documents in folders of international applications that have not entered the national stage may not be relied on. Notice of April 18, 1987 (1079 O.G. 32 to 46).*

19. Maintenance of Copendency of Prior Application

NOTE: *The PTO finds it useful if a copy of the petition filed in the prior application extending the term for response is filed with the papers constituting the filing of the continuation application. Notice of November 5, 1985 (1060 O.G. 27).*

A. ☐ Extension of time in prior application

(This item **must** be completed and the papers filed **in the prior application** if the period set in the prior application has run.)

☐ A petition, fee and response extends the term in the pending **prior** application until ___ _____.

☐ A **copy** of the petition filed in prior application is attached.

B. ☐ Conditional Petition for Extension of Time in Prior Application
(complete this item if previous item not applicable)

☐ A conditional petition for extension of time is being filed in the pending **prior** application.

☐ A **copy** of the conditional petition filed in the prior application is attached

20. Further Inventorship Statement Where Benefit of Prior Application(s) Claimed

*NOTE: "If the continuation, continuation-in-part, or divisional application is filed by less than all the inventors names in the prior application a statement **must** accompany the application when filed requesting deletion of the names of the person or persons who are not inventors of the invention being claimed in the continuation, continuation-in-part, or divisional application." 37 CFR 1.62(a) [emphasis added]. (dealing with the file wrapper continuation situation).*

NOTE: "In the case of a continuation-in-part application which adds and claims additional disclosure by amendment, an oath or declaration as required by § 1.63 must be filed. In those situations where a new oath or declaration is required due to additional subject matter being claimed, additional inventors may be named in the continuing application. In a continuation or divisional application which disclosed and claims only subject matter disclosed in a prior application, no additional oath or declaration is required and the application must name as inventors the same or less than all the inventors in the prior application." 37 CFR 1.60(c) (dealing with the continuation situation).

(complete applicable item (a), (b) and/or (c) below)

(a) ■ This application discloses and claims only subject matter disclosed in the prior application whose particulars are set out above and the inventor(s) in this application are

- ■ the same.
- ☐ less than those named in the prior application. It is requested that the following inventor(s) identified for the prior application be deleted:

_____

(type name(s) of inventor(s) to be deleted)

(b) ☐ This application discloses and claims only subject matter disclosed in the prior application whose particulars are set out above and the inventor(s) in this application are

- ☐ the same.
- ☐ the following additional inventor(s) have been added:

_____

(type name(s) of inventor(s) to be added)

(c) ■ The inventorship for all the claims in this application are

- ■ the same.
- ☐ not the same. An explanation, including the ownership of the various claims at the time the last claimed invention was made
  - ☐ is submitted.
  - ☐ will not be submitted.

21. Abandonment of Prior Application *(if applicable)*

☐ Please abandon the prior application at a time while the prior application is pending, or when the petition for extension of time or to revive in that application is granted, and when this application is granted a filing date, so as to make this application copending with said prior application.

NOTE: According to the Notice of May 13, 1983 (103, TMOG 6-7), the filing of a continuation or continuation-in-part application is a proper response with respect to a petition for extension of time or a petition to revive and should include the express abandonment of the prior application conditioned upon the granting of the petition and the granting of a filing date to the continuing application.

22. Petition for Suspension of Prosecution for the Time Necessary to File and Amendment

WARNING: "The claims of a new application may be finally rejected in the first Office action in those situations where (1) the new application is a continuing application of, or a substitute for, and earlier application, and (2) all the claims of the new application (a) are drawn to the same invention claimed in the earlier application, and (b) would have been properly finally rejected on the grounds of art of record in the next Office action if they had been entered in the earlier application." MPEP, § 706.07(b).

NOTE: Where it is possible that the claims on file will give rise to a first action final for this continuation application and for some reason an amendment cannot be filed promptly (e.g., experimental data is being gathered) it may be desirable to file a petition for suspension of prosecution for the time necessary.

(check the next item, if applicable)

☐ There is provided herewith a Petition To Suspend Prosecution for the Time Necessary to File An Amendment (New Application Filed Concurrently)

23. Small Entity (37 CFR § 1.28(a))

■ Applicant has established small entity status by the filing of a verified statement in parent application 60/ 005,685 on 10/17/95 .

☐ A copy of the verified statement previously filed is included.

WARNING: "Status as a small entity in one application or patent does not affect any other application or patent, including applications or patents which are directly or indirectly dependent upon the app/application or patent in which the status has been established. Applications filed as continuations, divisions or continuations-in-part of a parent application must include a reference to a verified statement filed in the parent application if status as a small entity is still proper and desired." 37 CFR § 1.28(a).

24. NOTIFICATION IN PARENT APPLICATION OF THIS FILING

☐ A notification of the filing of this

(Check one of the following)

☐ continuation

☐ continuation-in-part

☐ divisional

is being filed in the parent application, from which this application claims priority under 35 U.S.C. § 120.

08/727,789

Abstract

A plastic card, such as a radio frequency identification card, including at least one electronic element embedded therein and a hot lamination process for the manufacture of radio frequency identification cards and other plastic cards including a micro-chip embedded therein. The process results in a card having an overall thickness in the range of 0.028 inches to 0.032 inches with a surface suitable for receiving dye sublimation printing - the variation in card thickness across the surface is less than 0.0005 inches. A card manufactured in accordance with the present invention also complies with all industry standards and specifications. Also, the hot lamination process of the present invention results in an aesthetically pleasing card. The invention also relates to a plastic card formed in accordance with the hot lamination process of the present invention.

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RADIO FREQUENCY IDENTIFICATION CARD AND HOT LAMINATION PROCESS FOR THE MANUFACTURE OF RADIO FREQUENCY IDENTIFICATION CARDS

Field of the Invention

The present invention relates generally to plastic cards and the manufacture thereof, and more particularly to radio frequency identification (RFID) cards and the manufacture of RFID cards that conform to industry size and performance standards and conventions and that have a superior outer surface to known RFID cards such that card may receive dye sublimation printing or the like.

Background of the Invention

As the use of plastic cards for credit cards, automated teller machine (ATM) cards, identification cards, and like continues to become more widespread, the problems associated with the use of such cards correspondingly increase. Credit card fraud and identification card fraud are becoming larger problems everyday, and this fraud has introduced uncertainties into our systems of commerce and our security systems. Using easily available technology, criminals are able to manufacture credit/debit cards, ATM cards, identification cards, and the like having another's account code, identification code, or other personal information

embedded in the magnetic stripe thereof. Thus, for example, criminals may steal hundreds or thousands of legitimate credit card account numbers and manufacture many additional cards bearing the stolen information. These fraudulent cards are then usable by the criminals to purchase goods and to receive cash with the legitimate card holder and the card issuer left holding the bill. Likewise, so called debit cards are becoming increasingly popular. These cards have stored thereon a certain amount of value for which the card owner has previously paid. For example, a subway rider may purchase a card good for 50 fares, with one fare being deducted from the card each time the owner rides the subway. Criminals have also been able to manipulate the data stored on these cards to defraud the merchants and others.

The ease in which criminals have been able to manufacture and or manipulate known cards results from the existence of the easily altered magnetic stripe storage medium used by known cards. These magnetic stripes are easily programmed and reprogrammed using commonly available technology. Thus, there has been found a need in the plastic card industry to provide a more secure plastic card that is very difficult or impossible to fraudulently manipulate. The most likely solution to the above-noted problems associated with known plastic cards is the RFID card and other cards including computer chips embedded

therein rather than, or in addition to, a magnetic stripe. While these RFID cards and like have been found to be successful in preventing or limiting fraud, they are more difficult and expensive to manufacture relative to ordinary magnetic stripe cards. One of the biggest obstacles to the wide spread manufacture and use of RFID cards has been the inability of card manufacturers to manufacturer an RFID card that meets all industry standards and specifications, such as those set by the International Standards Organization (ISO), that are sufficiently aesthetically pleasing (wherein the embedded electronics are hidden from view), and that have a sufficiently regular or flat surface such that one or both surfaces of the card may be printed on using the very popular and widespread dye sublimation technology. Known plastic cards with computer chips and like embedded therein are too thick to work in connection with existing card reading machinery (ATM machines, telephones, and like) and have a surface that is too irregular to properly and consistently receive dye sublimation printing. Furthermore, prior attempts to manufacture a sufficiently thin plastic card including a computer chip embedded therein have resulted in a card with inferior aesthetic qualities such as the ability to see the embedded computer chip through the plastic.

Summary of the Invention

The present invention is therefore directed to a plastic card having at least one electronic element embedded therein and to a hot lamination method for the manufacture of plastic cards including at least one electronic element therein. The card has an overall thickness in the range of 0.028 inches to 0.032 inches and comprises a plastic core having at least one electronic element embedded therein with at least one of the upper and lower surfaces of the core comprising a coating printed or otherwise applied thereon. An overlaminate film is preferably provided over the coated surface of the core and the resulting card has a variation in thickness across the surfaces thereof of no greater than approximately 0.0005 inches. The hot lamination method of the present invention comprises the steps of providing first and second plastic core sheets, positioning at least one electronic element between the first and second core sheets to thus form a core, and placing the core in a laminator and closing the laminator without applying laminator ram pressure to the core. A heat cycle is applied to the core sheets in the laminator thus liquefying or partially liquefying the sheets. The laminator ram pressure is then increased in combination with the heat. A cooling cycle is then applied to the core in the laminator, preferably with an associated increase in ram pressure, and the core is

removed from the laminator. At least one surface of the core is then printed on using a printing press or similar printing apparatus, a sheet of overlaminate film is placed on at least one side of the core, and the core is then again placed in a laminator. A heat cycle is applied to the core with its overlaminate film, and a cooling cycle is thereafter applied, resulting in a sheet of plastic card stock from which one or more cards may be cut. The invention is also directed to a card manufactured in accordance with the above process which results in a plastic card having a thickness in the range of approximately 0.028 inches to 0.032 inches with a surface smoothness of at least approximately 0.0005 inches as is required by ISO and American National Standards Institute (ANSI) standards.

The present invention provides numerous advantages over known plastic cards and known plastic card manufacturing processes, including the formation of a plastic card with electronic elements such as a computer chip embedded therein with a pleasing aesthetic appearance, with a sufficiently smooth and regular surface such that the card may receive dye sublimation printing, and with sufficient durability and characteristics to comply with all industry specifications and standards.

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Brief Description of The Drawings

Fig. 1 is a top plan view of a plastic card in accordance with the present invention;

Fig. 2 is a side elevational view of the card shown in Fig. 1;

Figs. 3A-3C are top plan views of various electronic elements that may be embedded in a card in accordance with the present invention;

Fig. 4 is an exploded, schematic view of an electronic element position between two plastic core sheets to form a core;

Fig. 5 is a top plan view of a plurality of electronic elements positioned on a sheet of plastic core stock such that they may be covered by a similar sheet of core stock;

Fig. 6 is a schematic cross-sectional view of one or more electronic elements positioned between sheets of plastic core stock;

Fig. 7 schematically illustrates a book comprising the core, as it is positioned in a laminator apparatus;

Fig. 8 schematically illustrates the core as it is being printed on after removal from the laminator using a printing press or similar printing apparatus;

Fig. 9 is a cross-sectional view schematically illustrating the application of an overlaminate film to at least one side of the core;

Fig. 10 schematically illustrates the core with overlaminate film, as it is placed in a laminator for final processing to form a sheet of card stock.

Detailed Description of the Invention

The present invention relates to a plastic card including at least one electronic element embedded therein. The present invention also relates to a hot lamination process for the manufacture of plastic cards, and more particularly to a hot lamination process for the manufacturer of plastic cards that include an electronic element, such as a computer chip or other electronic element embedded therein. The electronic element may perform a wide variety of functions and take a wide variety of forms. Such cards, without regard to the particular electronic element embedded therein, will hereinafter be referred to as radio frequency identification (RFID) cards. The present invention also relates to a card formed in accordance with the invention.

Referring now to Fig. 1, there can be seen a plastic RFID card 10 manufactured in accordance with the present invention and including an electronic element 20 embedded therein. Card 10 includes an upper surface 12 and a lower surface 14. Electronic element 20 may take a wide variety of forms and perform a wide variety of functions. As shown

in Fig. 3A -3C respectively, electronic element 20, 20', 20" may be provided by a micro-chip 22 including a wire antenna 24 connected thereto, a micro-chip 22' and a circuit board antenna 24' , a read/write micro-chip 22" and a wire coil antenna 24", or any other suitable electronic element. These electronic elements 20, 20', 20" and their insertion into plastic cards is not new, however, the present invention provides a new hot lamination process for manufacturing plastic cards 10 with these electronic elements 20, 20', 20" embedded therein such that the cards 10 are of a superior quality, such that the cards 10 meet all ISO and other industry specifications and standards, in such that at least one of the upper and lower surfaces 12, 14 of card 10 is sufficiently smooth and is otherwise is capable of receiving dye sublimation printing. Specifically, a card in accordance with the present invention has a thickness of approximately in the range of 0.028 inches to 0.032 inches with a surface smoothness of 0.0005 inches.

As shown in Figs. 4-10 one or more cards 10 in accordance with the present invention may be manufactured by positioning an electronic element 20 between first and second sheets of card stock 30, 32 to form a core 33. Preferably is shown in Fig. 5-10, a plurality of cards are manufactured simultaneously, in thus, a plurality of

electronic elements 20 are positioned between the first and second sheets of plastic core stock 30, 32 (only the second sheet 32 begin shown in Fig. 5 for clarity). When a plurality of electronic elements 20 are positioned between first and second sheets plastic core stock 30, 32, electronic elements 20 are properly positioned relative to one another such that a plurality cards may be cut from the resulting card stock. Plastic core sheets 30, 32 may be provided by a wide variety of plastics, the preferred being polyvinyl chloride (PVC) having a thickness in the range of 0.007 inches to 0.024 inches and preferably having a thickness of approximately 0.0125 inches each. Those skilled in the art will recognize that the thickness of the plastic core sheets will depend upon the thickness of the one or more electronic elements that are to be embedded therebetween. Other suitable plastics that may be utilized include polyester, acrylonitrile-butadiene-styrene (ABS), and any other suitable plastic.

Subsequent to placing one or more electronic elements 20 between the first and second sheets 30, 32 of plastic core stock to form a core 33, this core 33 is placed in a laminator apparatus 40 of the type well known in the art of plastic card manufacturing. As is shown in Fig. 7, laminator 40 includes upper and lower platens 42,44 for applying ram pressure to an article positioned therebetween.

In addition to the ability to apply ram pressure, laminator 40 is preferably of the type having controlled platens 42,44 that may provide both heat and chill cycles and preferably includes cycle timer to regulate cycle time. Core 33 is positioned between first and second laminating plates 50, 52, one of which is preferably matte finished to provide laminated core 33 with at least one textured outer surface. First and second laminating pads 60, 62 are positioned outside of the laminating plates 50, 52, and first and second steel plates 70, 72 are likewise positioned outside of pads of 60, 62 and the entire assembly forms a book ~~35~~ 37 for being positioned in laminator 40 between platens 42, 44.

Once book ~~35~~ 37 is positioned in laminator 40 as shown in Fig. 7, the first lamination cycle is initiated by closing laminator platens 42, 44, preferably applying little or no ram pressure to book ~~35~~ 37. A laminator heat cycle is initiated, bringing the temperature of platens 42,44 up to a range of 275ºF to 400ºF, and most preferably up to a range of 300ºF to 370ºF for a period of greater than 5 minutes, and preferably in the range of 7 to 10 minutes. Once the heat cycle has been applied to the book 35 as is set forth above, the ram pressure of laminator 40 is increased to facilitate the flow of the plastic core sheets 30, 32 so that the one or more electronic elements 20 are encapsulated there by, and so that sheets 30, 32 form a uniform core 33

(seen most clearly in Figs. 8-10) with upper and lower surfaces 34,35. As mentioned, the use of matte finished laminator plates 50,52 provides surfaces 34,35 with a slightly roughened or textured quality which will facilitate the application of a coating thereto as is discussed below. The ram pressure applied during the heat cycle and the length of the heat cycle may vary, depending especially upon the size of sheets 30, 32. For example, the cycle time may be in the range of 10-15 minutes. In one example, a ram pressure of 940.135 pounds per square inch (p.s.i.) was applied for 10-15 minutes to form a uniform core 33, using sheets 30,32 of a size in the range of 12 inches by 24 inches to 24 inches by 36 inches.

Subsequent to the above heat cycle, laminator 40 applies a chill cycle to book ~~35~~ 37 during which time the ram pressure of the laminator 40 is increased, preferably by approximately 25% until the platens 42,44 have cooled to approximately 40ºF to 65ºF for approximately 10-15 minutes. Core 33 may then be removed from laminator 40 for additional processing.

Subsequent to the removal of core 33 from laminator 40, and as illustrated in Fig.8, core 33 is coated on at least one of it's upper and lower surfaces 34, 35 with a layer of printing ink 36. This may be accomplished using a wide variety of printing techniques such as offset printing,

letterpress printing, screen printing, roller coating, spray printing, litho-printing, and other suitable printing techniques. As shown in Fig. 8, core 33 is fed in the direction indicated with arrow A through a printing press, a lithographic printer, or a similar apparatus 80. This printing step is performed to coat at least one surface 34, 35 of core 33 with a layer of aesthetically pleasing ink 36. This layer of ink 36 cosmetically hides the one or more electronic elements 20 that are embedded within core 33, and prevents these one or more electronic elements 20 from showing through the relatively thin core 33. In this manner, the one or more electronic elements 20 encapsulated in core 33 are completely hidden from view without requiring the plastic used in the manufacture core 33 to be excessively thick.

Referring now to Figs. 9-10, the final processing of core 33, which now comprises a layer of ink 36 or the like on at least one surface 34,35 thereof, is schematically illustrated. A layer of overlaminate film such as clear overlaminate film 38,39 is positioned on at least one ink coated surface 34,35 of core 33, and preferably core 33 is positioned between two similar sheets of overlaminate film 38,39 as shown. Overlaminate film is very thin, for example in the range of 0.0015" thick. A book 135 is then constructed for insertion into laminator 40 as is

schematically illustrated Fig. 10. Book 135 comprising core 33, including at least one layer of ink 36 and at least one layer of overlaminate film 38, 39 is positioned between laminating plates which are preferably highly polished plates such as mirror finished stainless steel plates 90, 92. Book 135 also comprises first and second laminating pads 60, 62 and first and second steel plates 70, 72 as is discussed above in relation to Fig. 7.

When book 135 is positioned between upper and lower platens 42,44 of laminator 40 as shown in Fig. 10, the laminator is closed and a heat cycle in the range of 175º F to 300º F, and most preferably in the range of 180ºF to 275ºF, is applied to book 135 for a period of 10 to 25 minutes with a ram pressure that varies depending upon sheet size or the ram size of the laminator 40, but which is typically approximately 1000 p.s.i. with an 18 inch diameter ram. The laminator 40 is then caused to execute a chill cycle, preferably with a corresponding increase in ram pressure. For example, the chill temperature may be in the range of 40º F to 65º F and last for a period of 10 to 25 minutes. A ram pressure increase of approximately 25% over the pressure used for the heat cycle has been found to be most preferable.

Subsequent to the above described second lamination cycle as illustrated in Fig. 10, a sheet of plastic card

stock is provided which comprises at least core 33 with at least one surface 34,35 thereof covered by a layer of ink 36, and with at least one surface 34,35 thereof covered by a layer of overlaminate film 38, 39. Preferably plastic card stock manufactured in accordance with the present invention comprises core 33 covered on both surfaces 34,35 with a layer of ink 36 which is positioned between layers of overlaminate film 38,39, all of which has been laminated together as described. One or more cards 10 then may be cut from the resulting plastic card stock and card 10 will have a thickness in the range of 0.028 inches to 0.032 inches with variation in overall thickness across the surfaces 12, 14 thereof being no greater than approximately 0.0005 inches. The one or more cards 10 can thus be said to have a surface smoothness of approximately 0.0005 inches or better. Thus, a card 10 manufactured in accordance with the present invention includes at least one surface 12,14 at preferably both surfaces 12,14 that are sufficiently smooth and regular to receive dye sublimation printing.

Those skilled in the art will recognize that the foregoing description has set forth the preferred embodiment of the invention in particular detail and it must be understood that numerous modifications, substitutions, and changes may be undertaken without departing from the true

spirit and scope of the present invention as defined by the ensuing claims.

What is claimed is:

1. A hot lamination process for the manufacture of a plastic card, said process comprising the steps of:

(a) providing first and second plastic core sheets;

(b) positioning at least one electronic element between said first and second plastic core sheets to form a layered core;

(c) positioning said core in a laminator apparatus, heating said core in said laminator, thereafter applying ram pressure to said core such that said at one electronic element is encapsulated in said core, and thereafter cooling said core in conjunction with laminator ram pressure being applied to said core, said core including an upper and lower surfaces;

(d) printing on at least one of said upper and lower surfaces of said core such that a layer of ink is applied to said at least one upper and lower surface of said core;

(e) positioning said core in a laminator apparatus with a layer of overlaminate film on at least one of said upper and lower surfaces of said core and laminating said layer of overlaminate film to said core in said laminator to thereby form a sheet of plastic card stock; and,

(f) cutting at least one card from said sheet of plastic card stock.

2. A hot lamination process as recited in claim 1, wherein said step (c) of positioning said core in a laminator apparatus is carried out by positioning said core between first and second laminating plates, at least one of said first and second laminating plates having a matte finish to provide at least one of said upper and lower core surfaces with a correspondingly textured surface.

3. A hot lamination process as recited in claim 2, wherein each of said first and second laminating plates includes matte finish to provide both of said upper and lower surfaces of said core with a correspondingly textured surface.

4. A hot lamination process as recited in claim 1, wherein said first and second plastic core sheets are made from a material selected from the group consisting of polyvinyl chloride, polyester, and acrylonitrile-butadiene-styrene, wherein each of said sheets has a thickness in the range of 0.007 inches to 0.024 inches.

5. A hot lamination process as recited in claim 4, wherein said first and second plastic core sheets have a thickness of approximately 0.0125 inches.

6. A hot lamination process as recited in claim 1, wherein said step (c) is carried out by:

(c1) constructing a first book including said core and at least first and second laminating plates respectively adjacent to said upper and lower surfaces of said core ;

(c2) positioning said book in said laminator apparatus;

(c3) closing said laminator apparatus and heating said core for a first predetermined amount of time without applying essentially any laminator ram pressure to said core;

(c4) increasing said laminator ram pressure following the passage of said first predetermined amount of time to apply pressure to said core in conjunction with said heating of said core; and,

(c5) cooling said core in said laminator in conjunction with laminator ram pressure being applied to said core.

7. A hot lamination process as recited in claim 6, wherein said step (c5) is carried out with a ram pressure that is greater than the ram pressure utilized in step (c4).

8. A hot lamination process as recited in claim 7, wherein the laminator pressure utilized in step (c5) is at least approximately 25% greater than the ram pressure utilized in step (c4).

9. A hot lamination process as recited in step 6, wherein at least one of said first and second laminating plates is a matte finished laminating plate to provide at least one of said upper and lower surfaces of said core with a corresponding matte finish.

10. A hot lamination process as recited in claim 9, wherein both of said first and second laminating plates are matte finished laminating plates to provide each of said upper and lower surfaces of said core with a corresponding matte finish.

11. A hot lamination process as recited in claim 6, wherein said step (c3) is carried out by heating said core to a temperature in the range of 300°F to 370°F for at least 5 to 10 minutes.

12. A hot lamination process as recited in claim 11, wherein said step (c4) is carried out by increasing said laminator ram pressure to a pressure approximately in the range of 700 p.s.i. to 1000 p.s.i. for at least 10 minutes.

13. A hot lamination process as recited in claim 1, wherein said step (d) is carried out utilizing a printing press.

14. A hot lamination process as recited in claim 1, wherein said step (d) is carried out utilizing a coating techniques selected from the group consisting of silk screen printing, offset printing, letterpress printing, screen printing, roller coating, spray printing, and litho-printing.

15. A hot lamination process as recited in claim 1, wherein said step (e) is carried out by positioning said core between first and second sheets of overlaminate film such that a layer of overlaminate film is laminated to both said upper and lower surfaces of said core.

16. A hot lamination process as recited in claim 1, wherein said at least one electronic element is a micro-chip and an associated wire antenna.

17. A hot lamination process as recited in claim 1, wherein said at least one electronic element is a micro-chip and an associated circuit board antenna.

18. A hot lamination process as recited in claim 1, wherein said at least one electronic element is a read/write integrated chip and an associated antenna.

19. A hot lamination process as recited in claim 1, wherein said step (e) is carried out by positioning said core with said layer of overlaminate film in said laminator apparatus between first and second laminating plates, wherein at least one of said first and second laminating plates includes a highly polished surface in contact with said layer of overlaminate film.

20. A plastic card constructed in accordance with claim 1.

21. A plastic card comprising:

a plastic core including at least one electronic element embedded therein, said core having an upper surface and a lower surface;

a coating on at least one of said upper and lower surfaces; and,

a layer of overlaminate film positioned on said at least one coated surface, wherein said card has an overall thickness in the range of approximately 0.028 inches to 0.032 inches with a variation in overall thickness across the upper and lower surfaces being no greater than approximately 0.0005 inches.

22. A plastic card as recited in claim 21, wherein said core is made from a plastic selected from the group consisting of polyvinyl chloride, polyester, and acrylonitrile-butadiene-styrene